

FIG. 1

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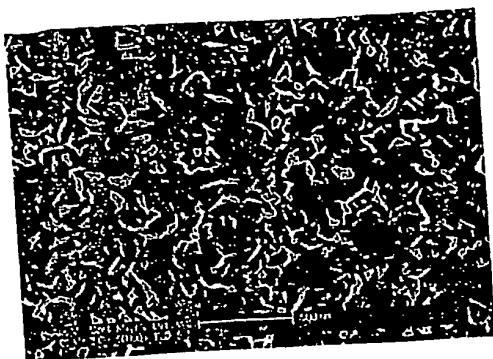


FIG. 2A

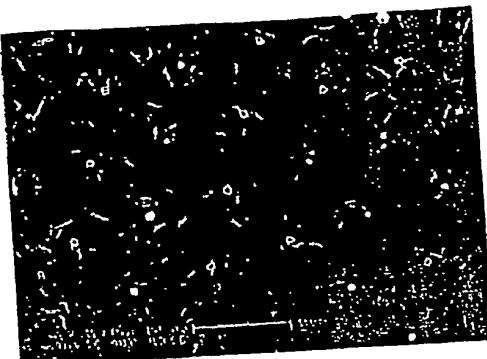


FIG. 2D



FIG. 2B



FIG. 2E

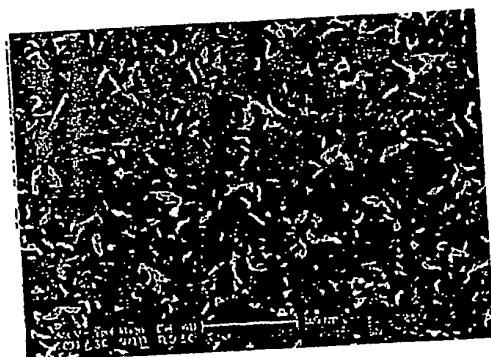


FIG. 2C

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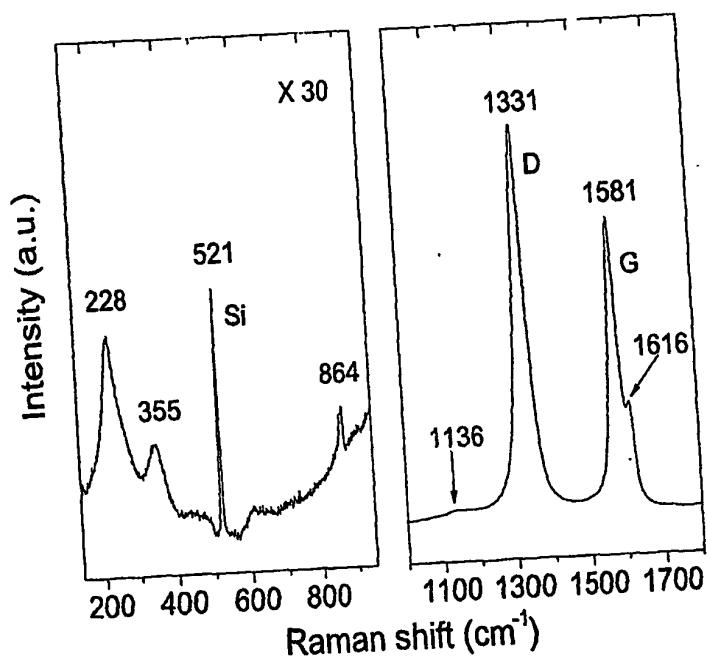


FIG. 3

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FIG. 4

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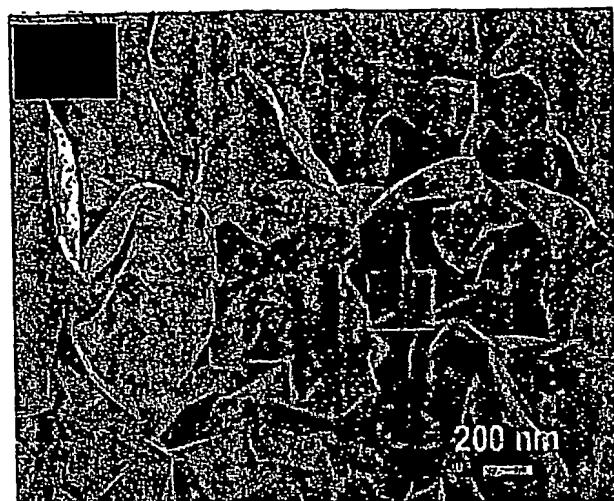


FIG. 5A

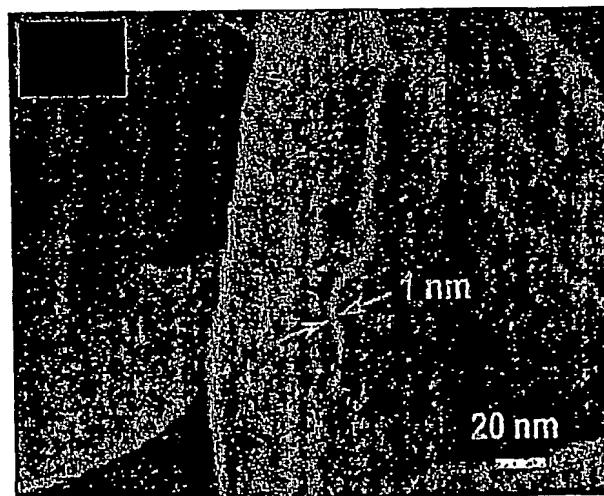


FIG. 5B

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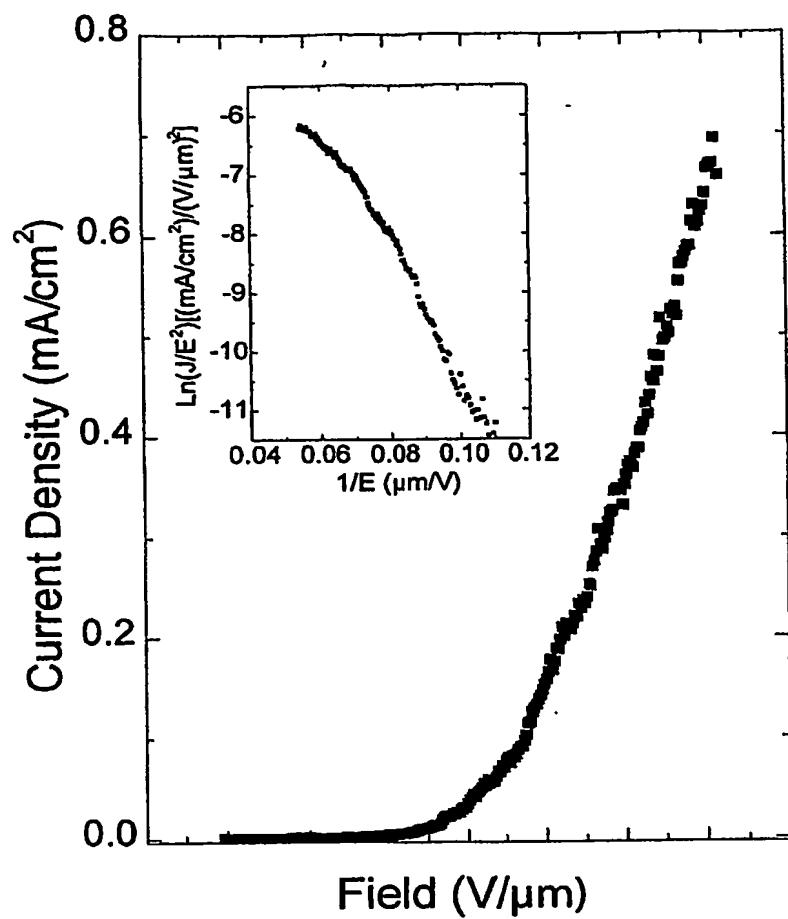


FIG. 6

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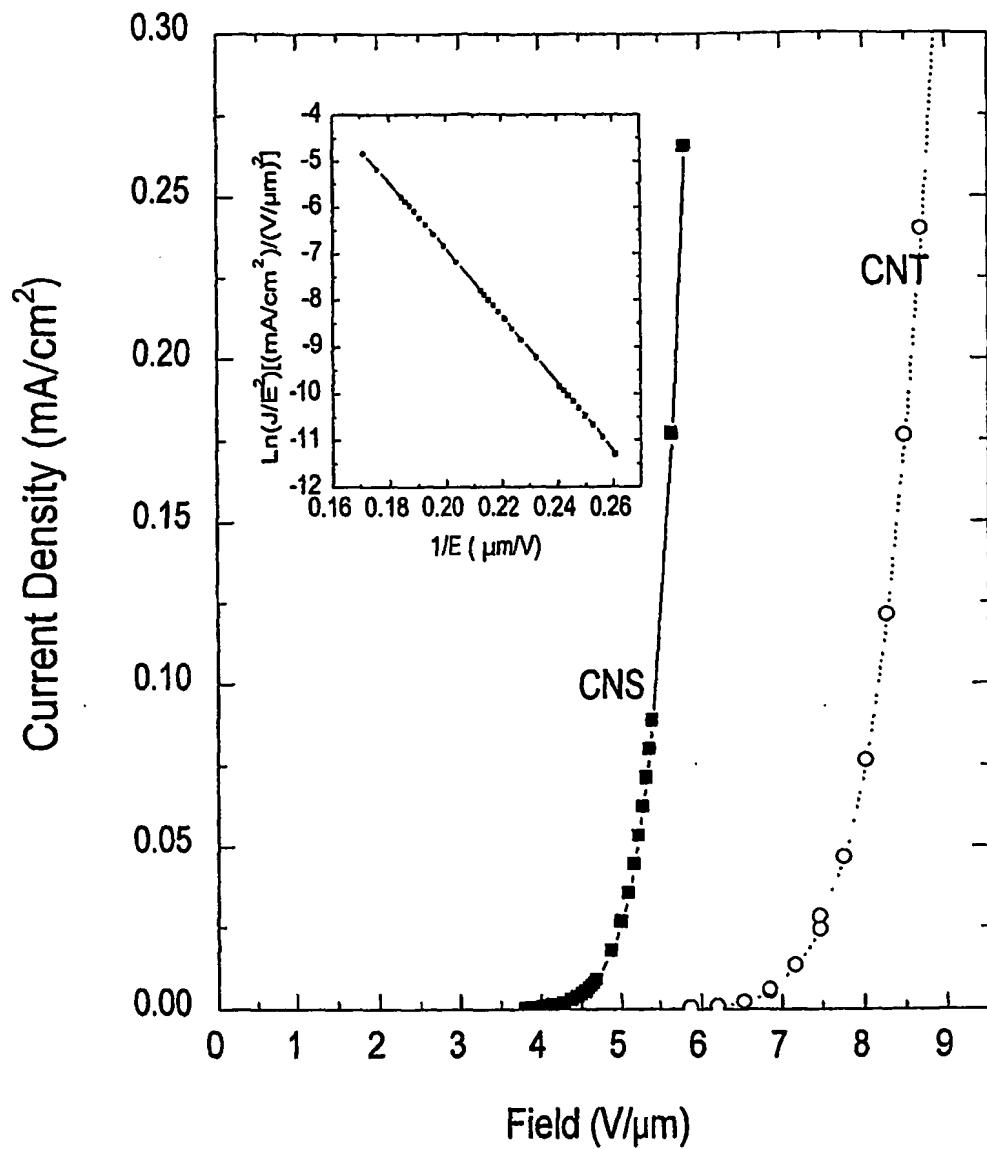


FIG. 7

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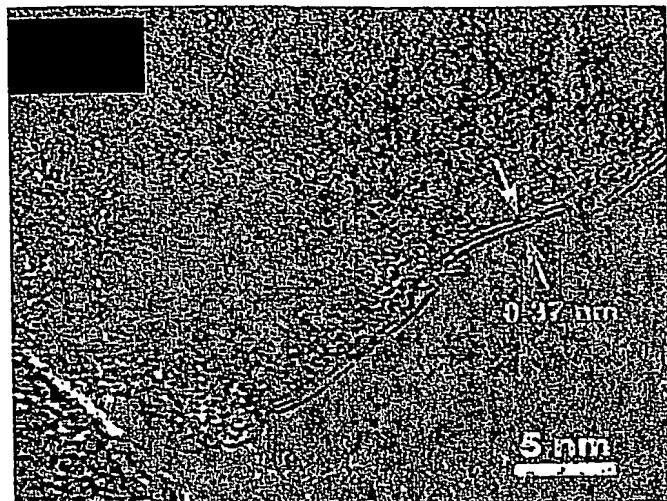


FIG. 8A

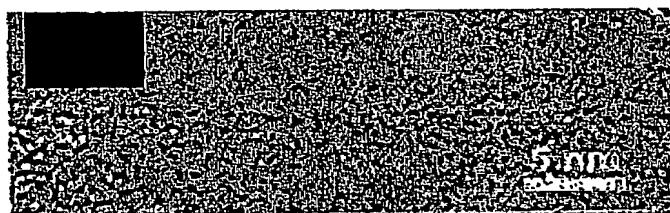


FIG. 8B

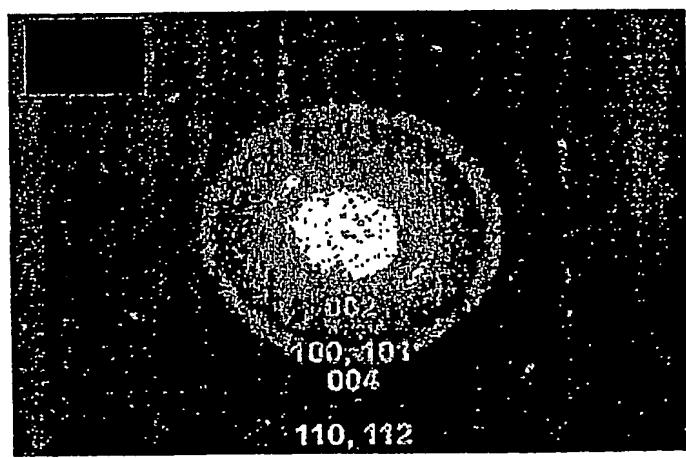


FIG. 8C

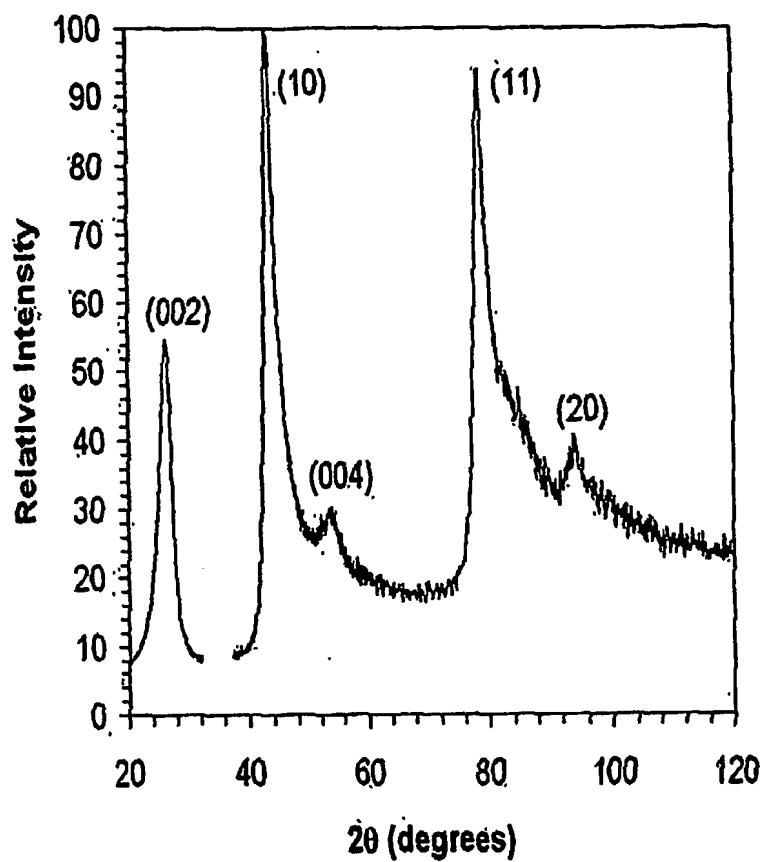


FIG. 9

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FIG. 10A

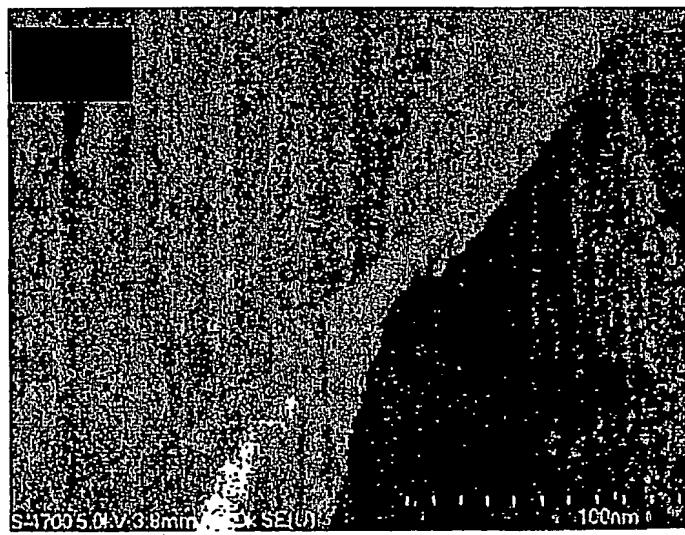


FIG. 10B

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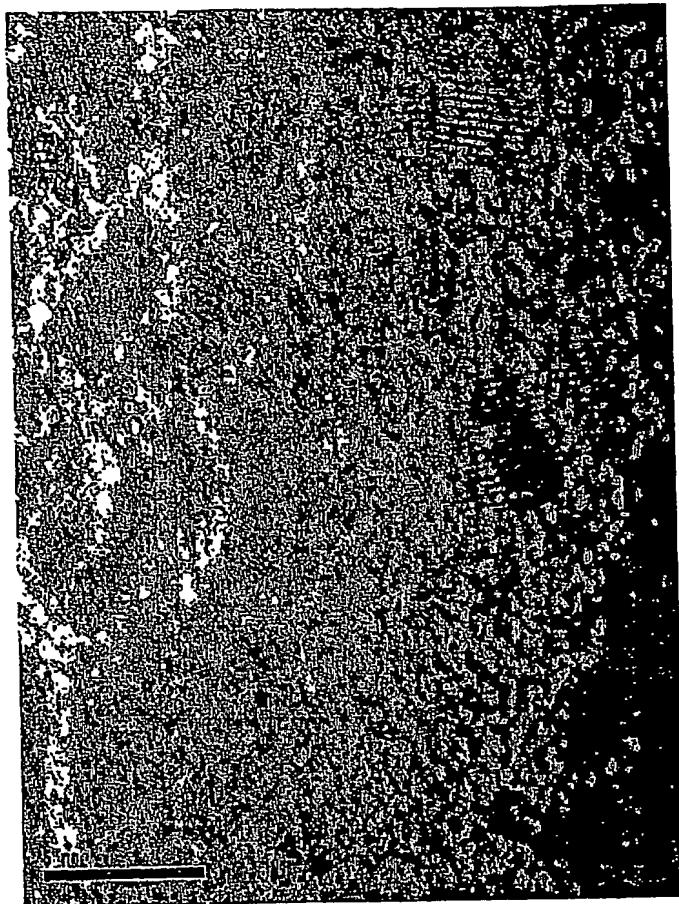


FIG. 11

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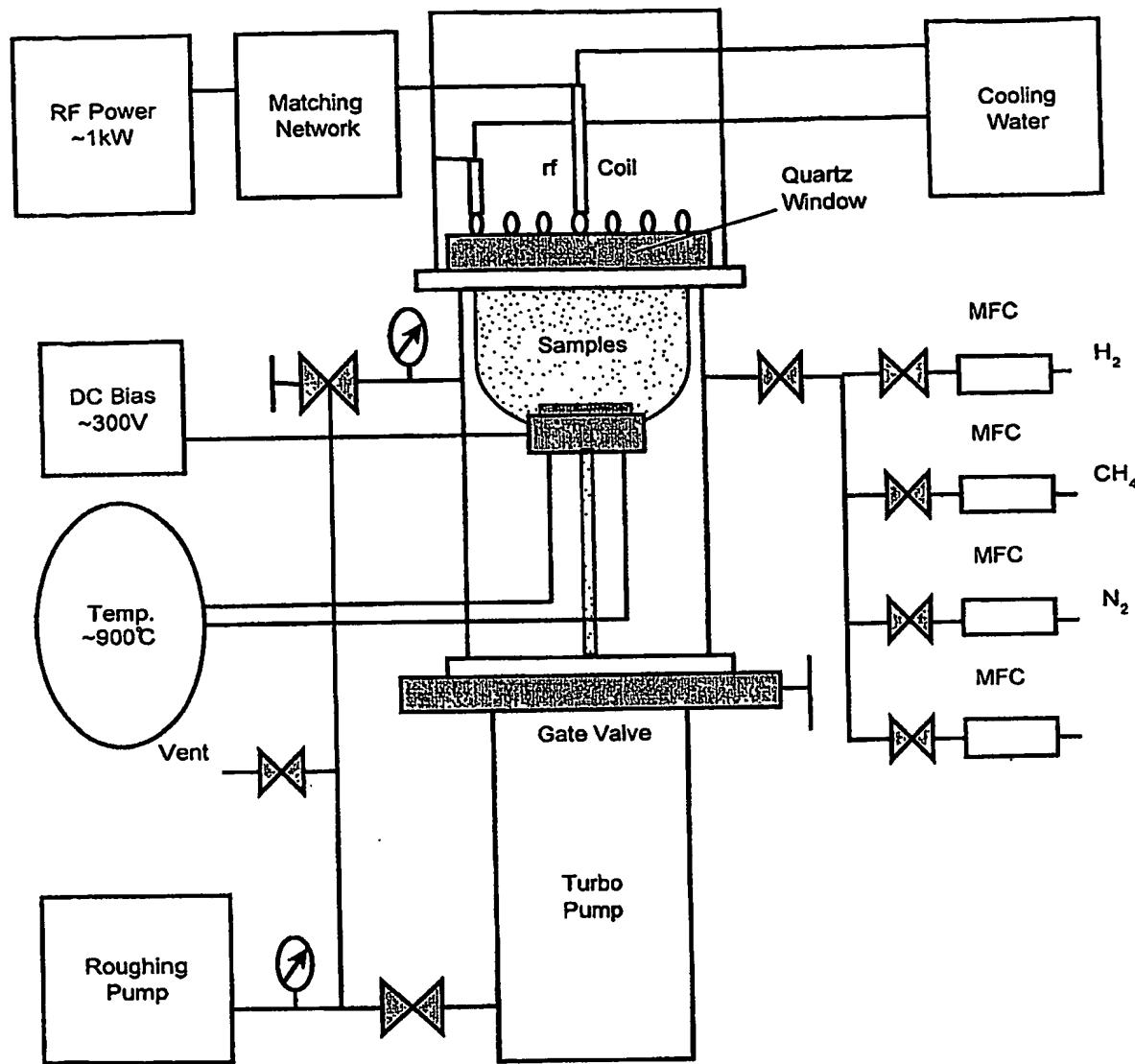


FIG. 12

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FIG. 13A

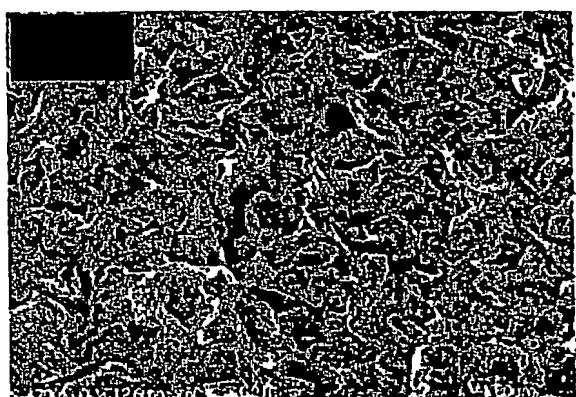


FIG. 13B

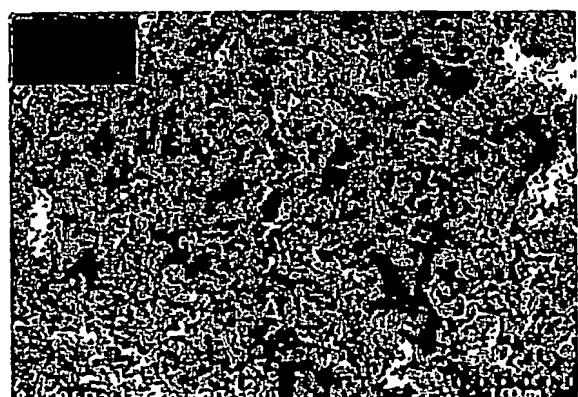


FIG. 13C

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FIG. 14A

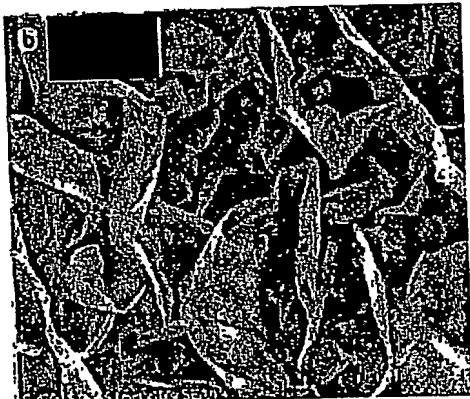


FIG. 14B



FIG. 14C



FIG. 14D

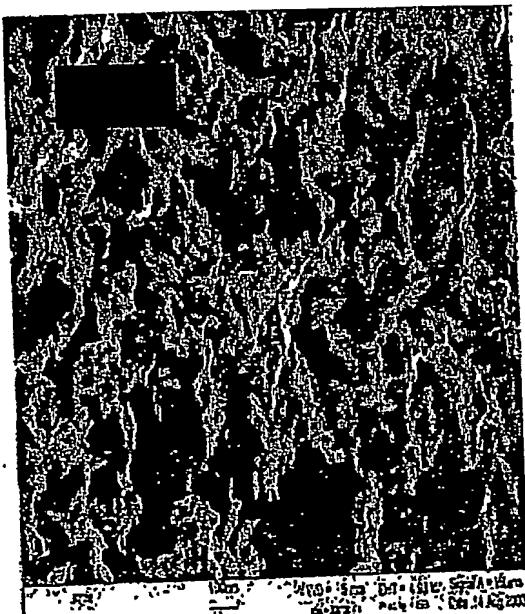


FIG. 14E

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Nanosphere Lithography Approach to Carbon Nanotube

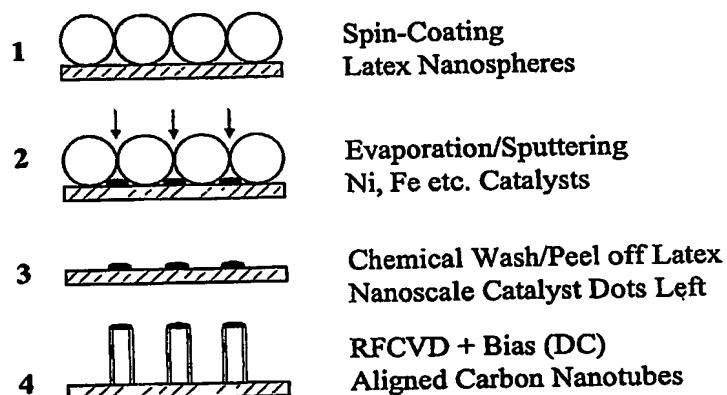
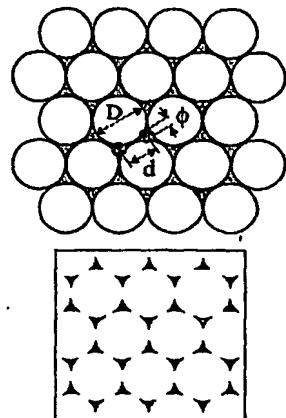


FIG. 15

Latex Nanosphere Lithography Pattern (Single-Layer)



Intersphere hole spacing:

$$d_{SL} = \frac{D}{\sqrt{3}} = 0.577D$$

Intersphere hole equivalent diameter:

$$\phi_{SL} = \left[\frac{4}{\pi} \cdot \left(\frac{1}{2} \cdot \frac{\sqrt{3}}{2} - \frac{1}{4} \cdot \frac{1}{6} \cdot 3 \cdot \pi \right) \right]^{\frac{1}{2}} D \approx 0.23D$$

| | | | | |
|----------------------|-----|-----|-----|-----|
| D, nm | 419 | 269 | 171 | 100 |
| d _{SL} , nm | 241 | 155 | 99 | 58 |
| ϕ _{SL} , nm | 96 | 62 | 39 | 23 |

FIG. 16

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Comparison of SL and DL Patterns

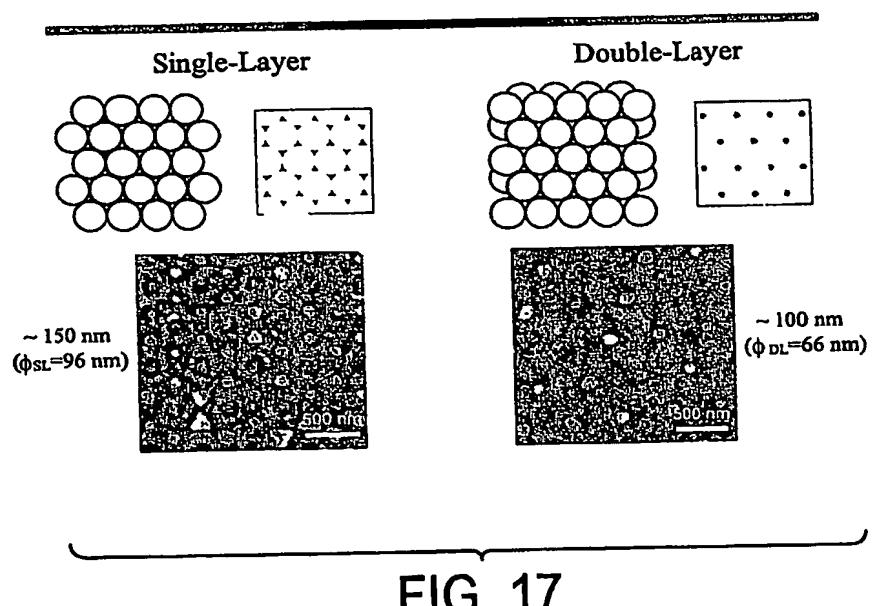
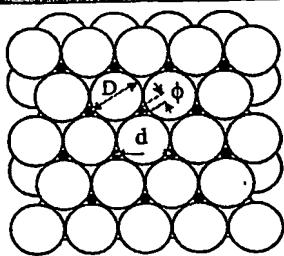


FIG. 17

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Latex Nanosphere Double-Layer Pattern

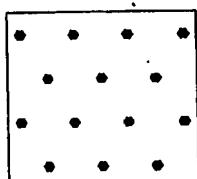


Intersphere hole spacing:

$$d_{DL} = D$$

Intersphere hole equivalent diameter:

$$\phi_{DL} \approx \left[\frac{4}{\pi} \cdot 6 \cdot \frac{1}{2} \cdot \frac{0.155}{2} \cdot 2 \cdot \operatorname{tg} 30 \cdot \frac{0.155}{2} \right]^{\frac{1}{2}} D \approx 0.16D$$



| D, nm | 419 | 269 | 171 | 100 |
|----------------------|-----|-----|-----|-----|
| d _{SL} , nm | 241 | 155 | 99 | 58 |
| ? _{SL} , nm | 66 | 43 | 27 | 16 |

FIG. 18

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Annealing of Ni Nanoscale Patterns - I
Single-layer latex mask

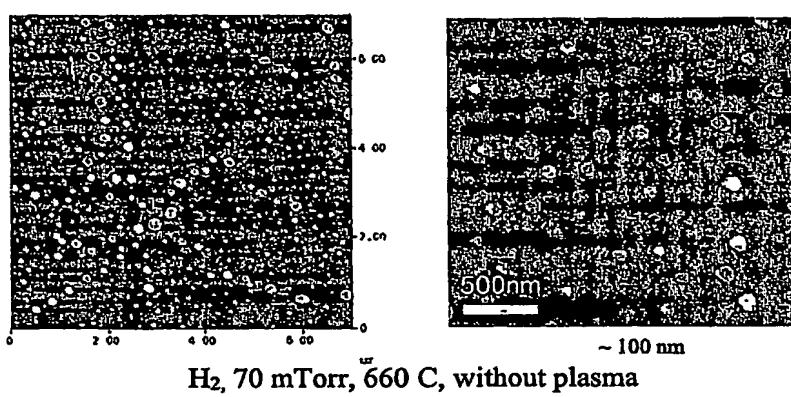
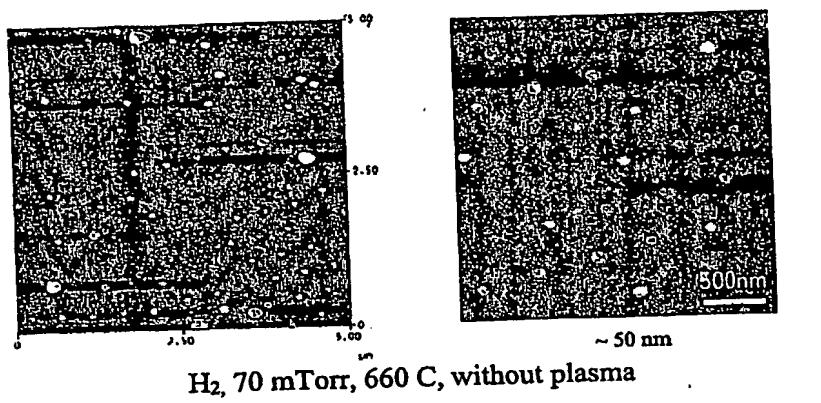


FIG. 19

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Annealing of Ni Nanoscale Patterns - II
Double-layer latex mask



H_2 , 70 mTorr, 660 C, without plasma

FIG. 20

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Latex Nanosphere Masks (AFM Images)

Latex/Triton X-100/Methanol, Spin coating

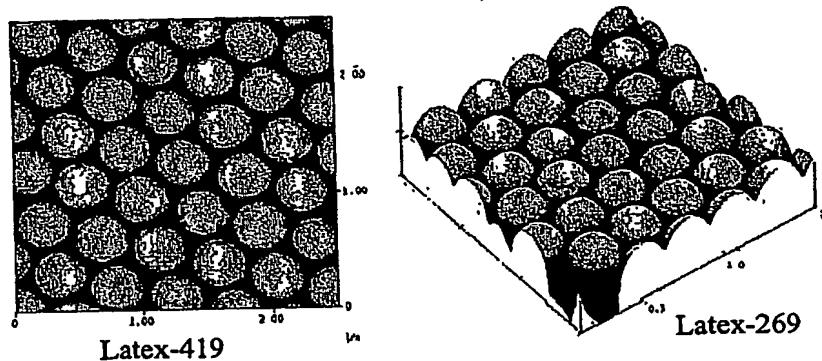


FIG. 21

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Defects of Latex Nanosphere Mask

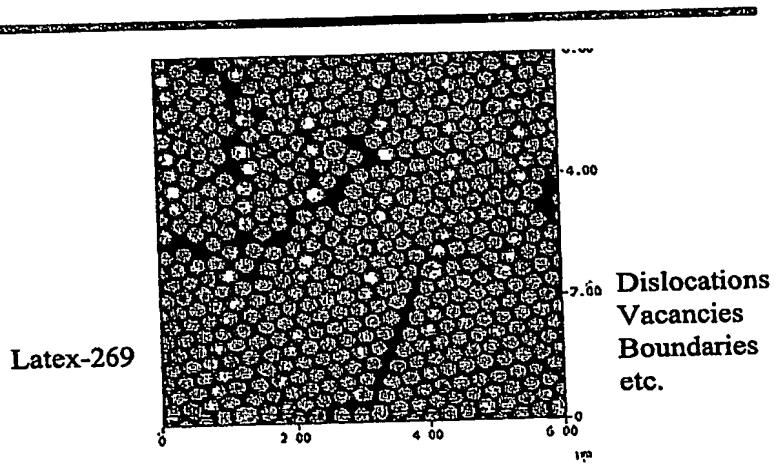


FIG. 22

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**Ni Pattern via E-Beam Evaporation
(20 nm, latex-419 mask)**

Latex removed by CH_2Cl_2 or mechanical method

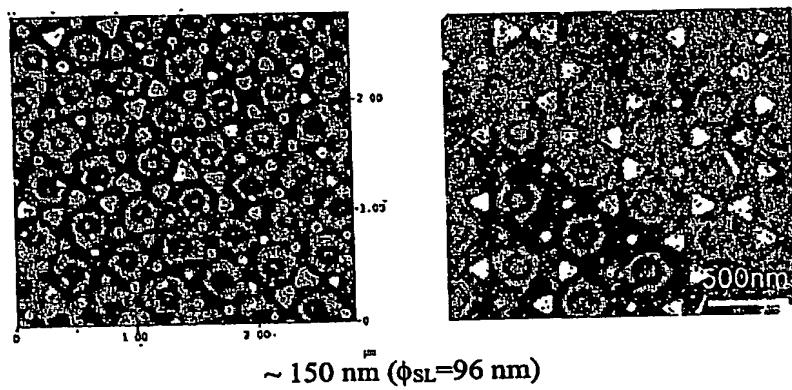


FIG. 23

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Schematic of RF-CVD System

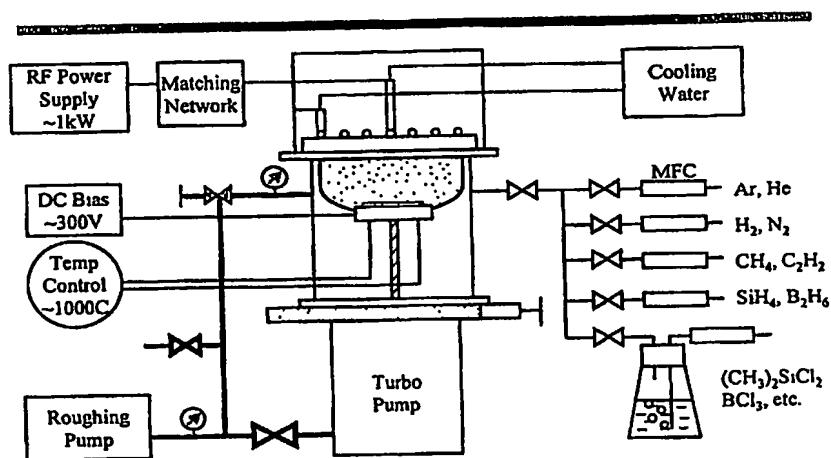


FIG. 24

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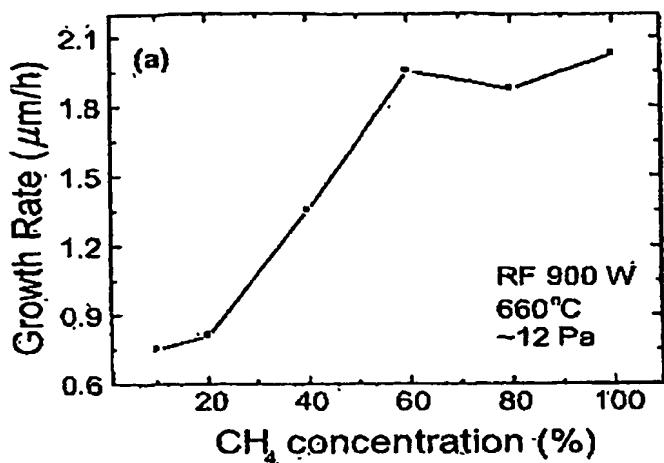


FIG. 25A

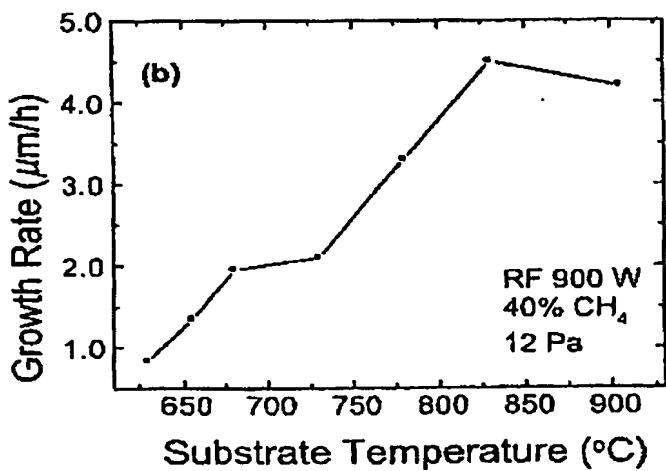


FIG. 25B

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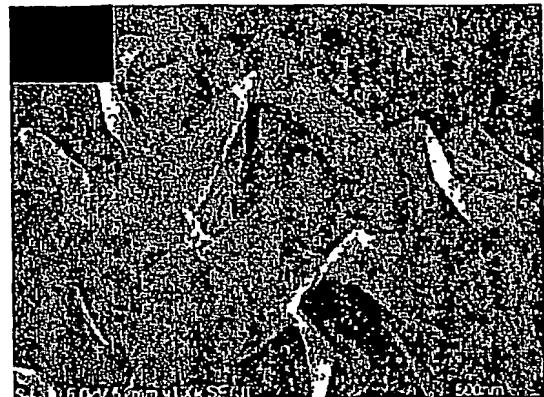


FIG. 26A

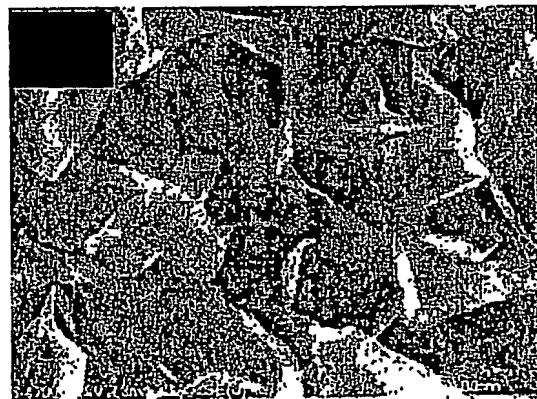


FIG. 26B

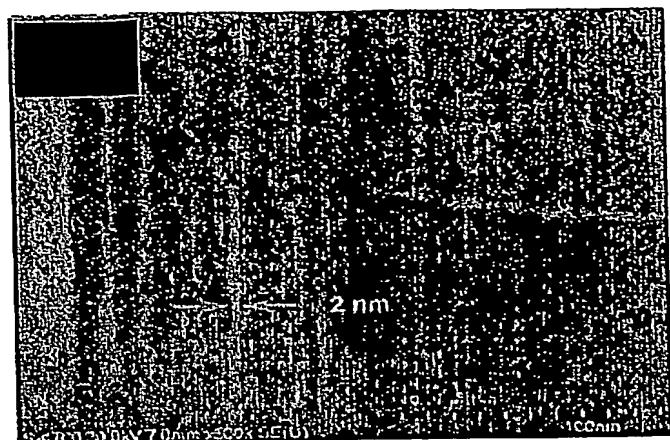


FIG. 27A

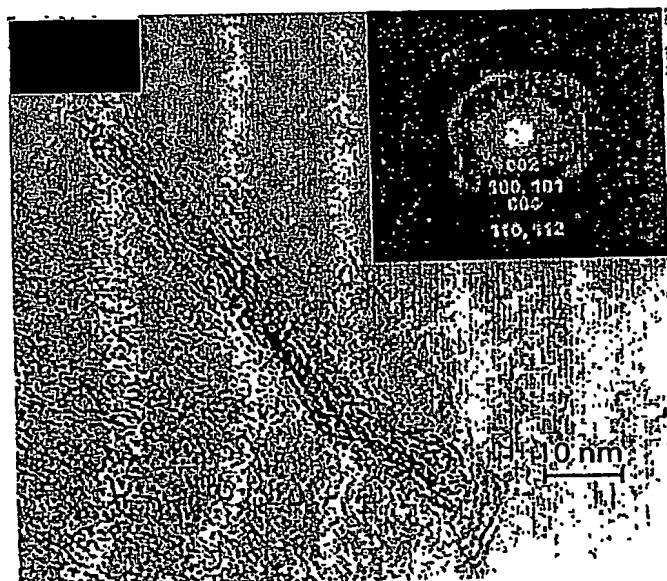


FIG. 27B

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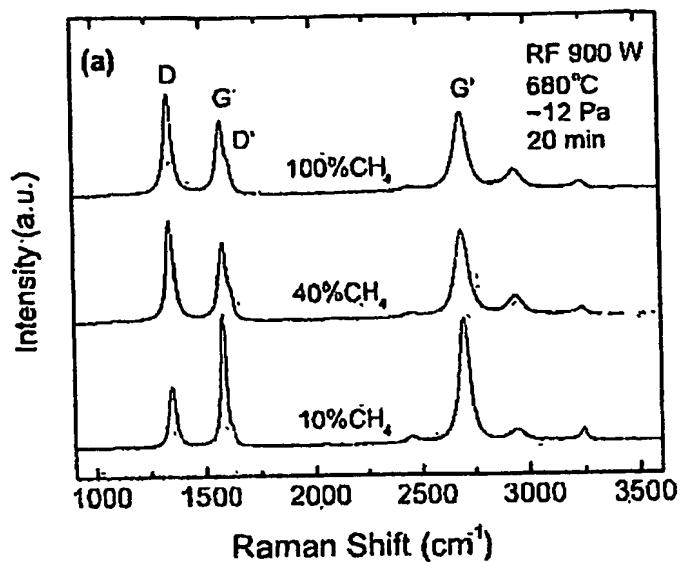


FIG. 28A

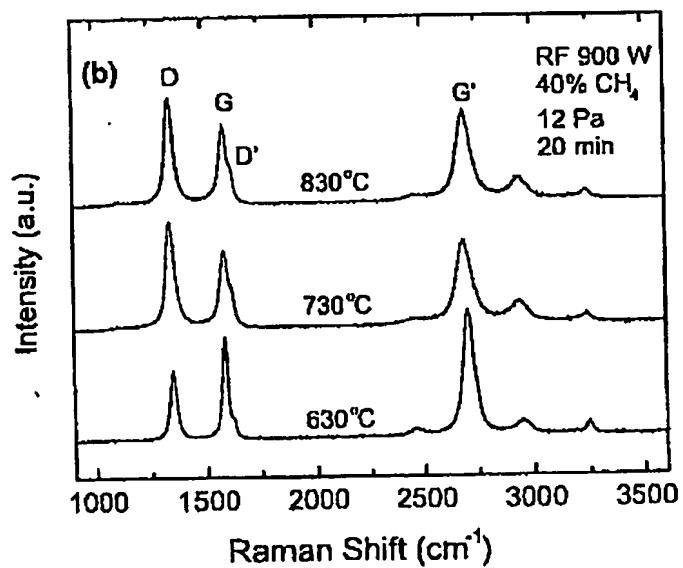


FIG. 28B

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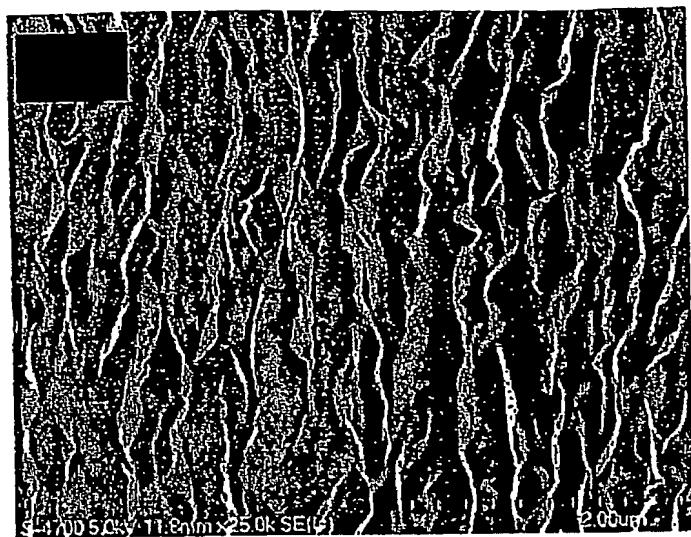


FIG. 29A

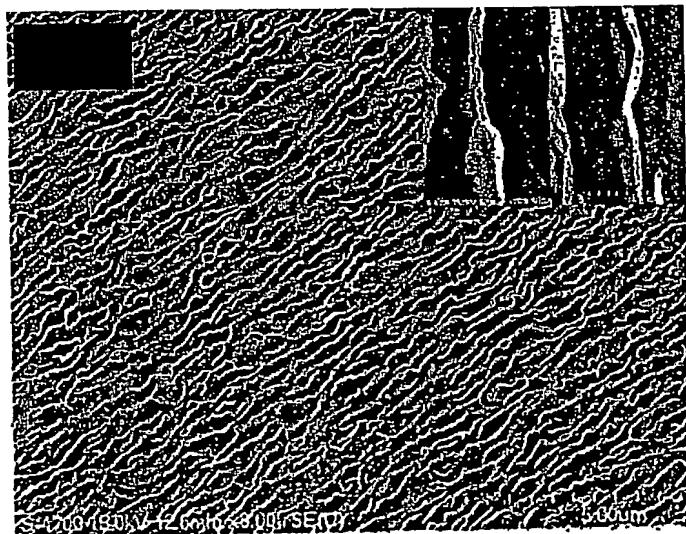


FIG. 29B

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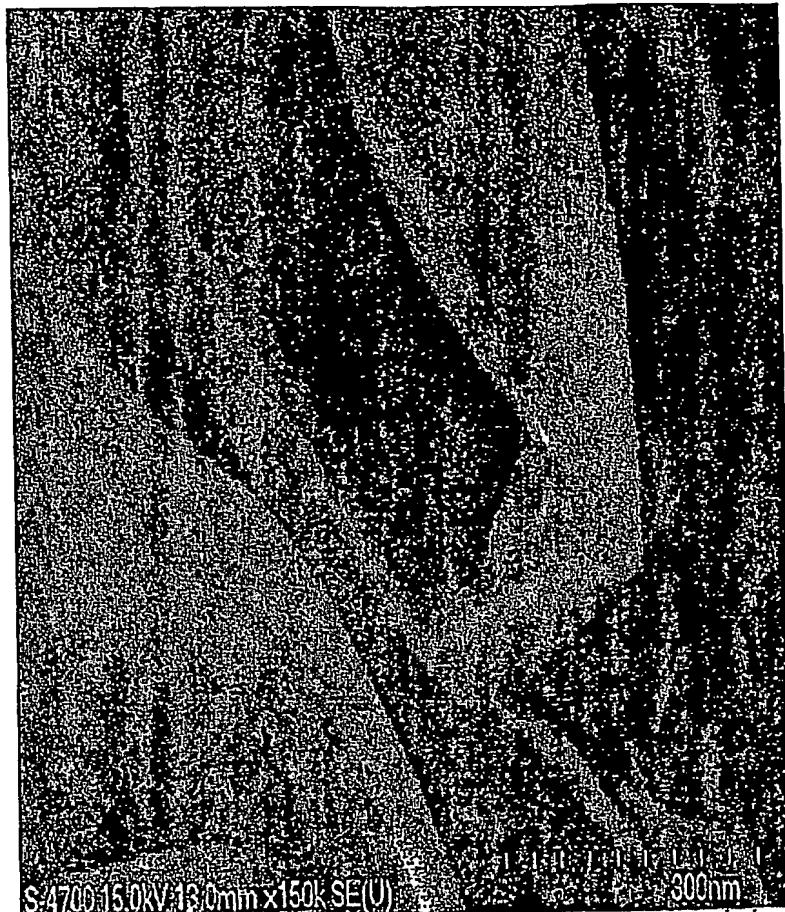


FIG. 30

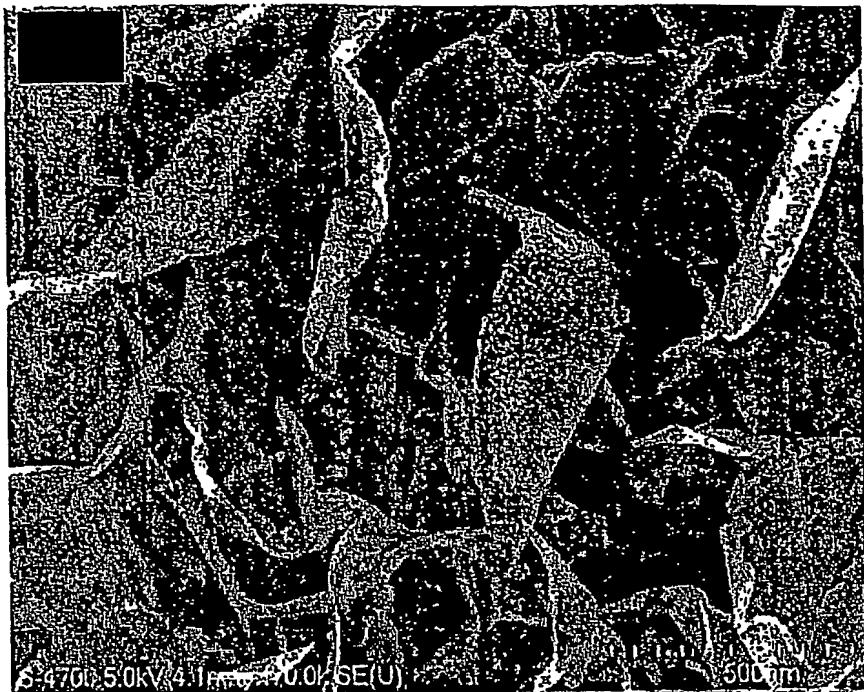


FIG. 31A



FIG. 31B

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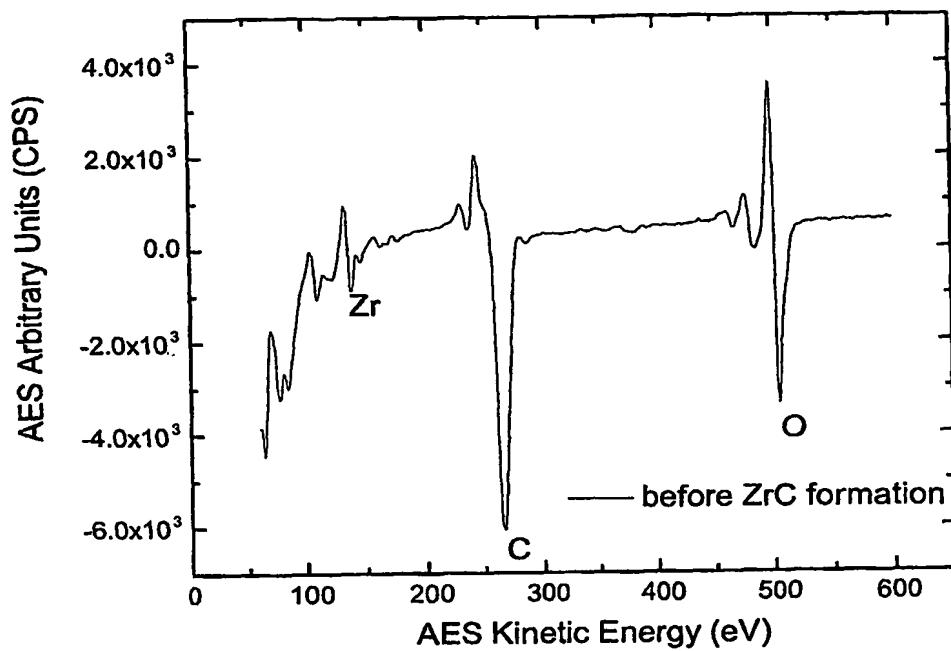


FIG. 32

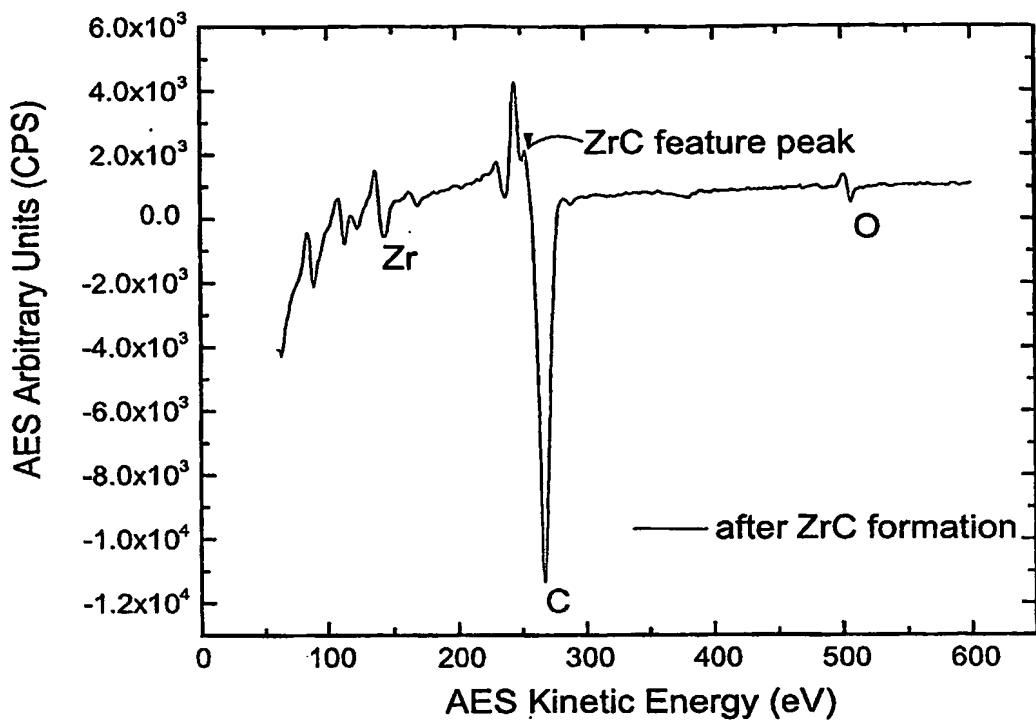


FIG. 33

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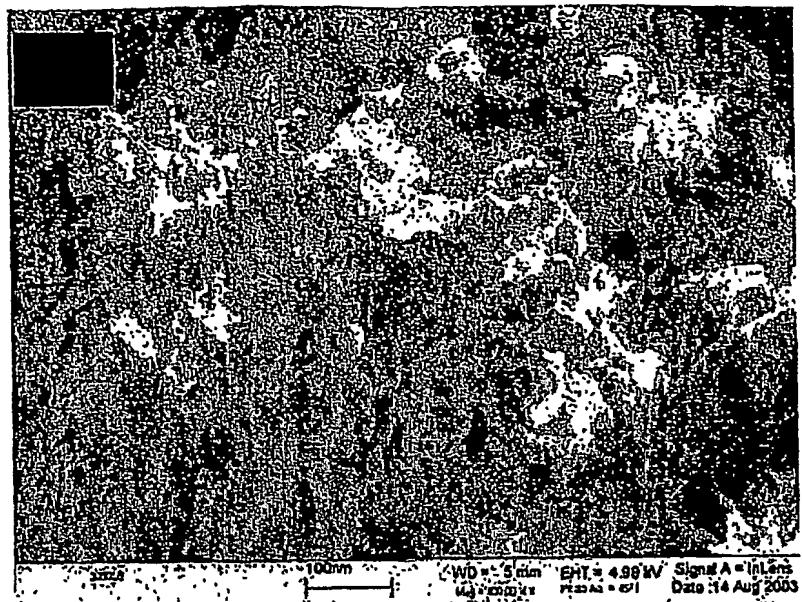


FIG. 34A



FIG. 34B

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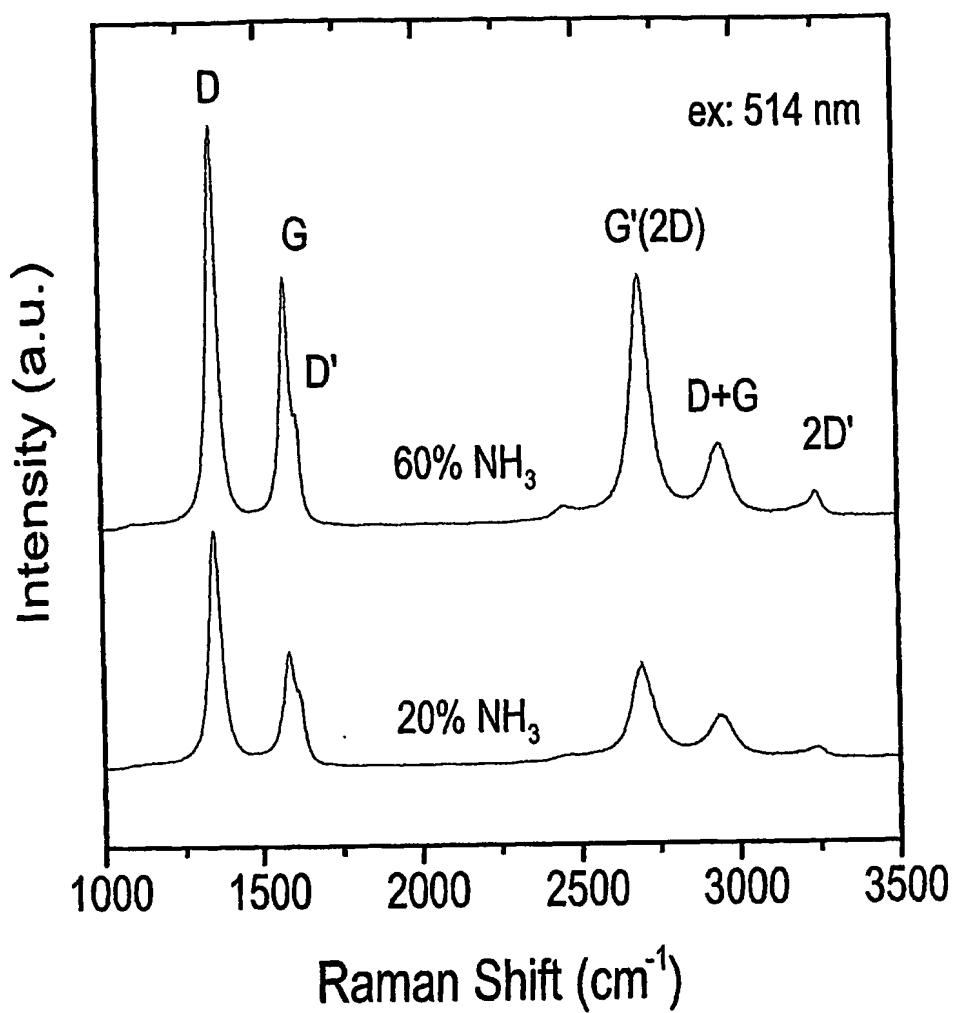


FIG. 35

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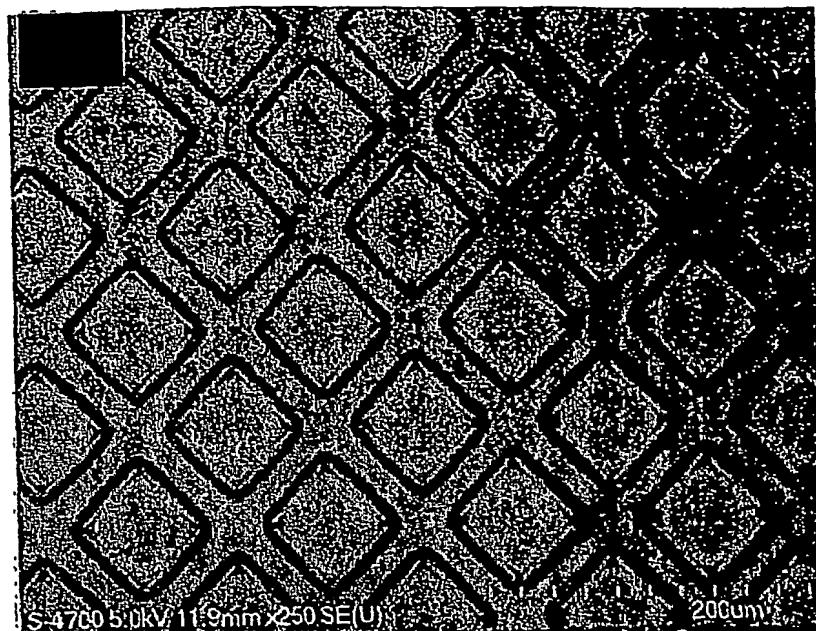


FIG. 36A

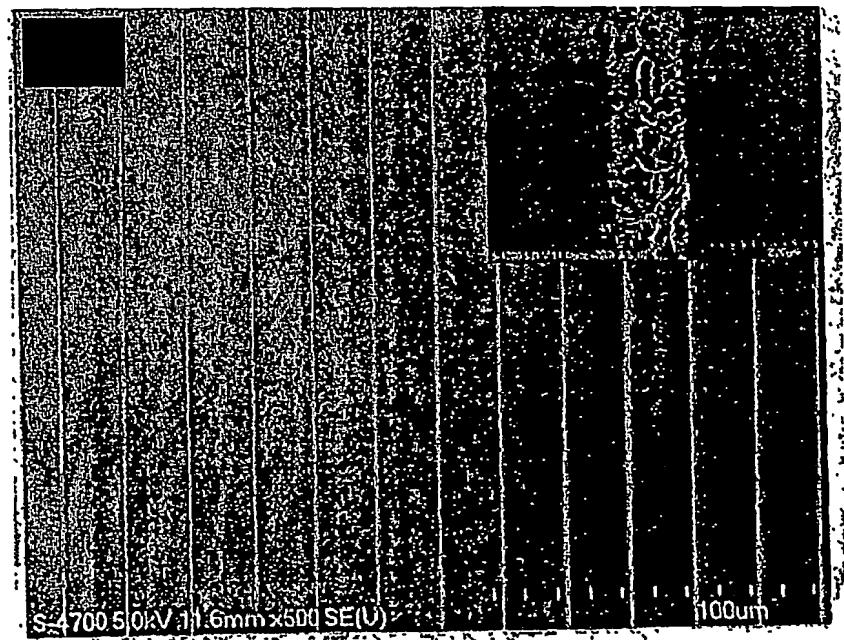


FIG. 36B

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